# MATH231BR HOMEWORK 1 (DUE THURSDAY, 2/5/26)

**Exercise 1.** Let $\pi \colon S \to X$ be any sheaf and $z \colon X \to S$ the zero section. Then $\mathrm{im}(z) \subseteq S$ is open.

**Exercise 2.** Show that every morphism between sheaves of abelian groups is a local homeomorphism.

**Exercise 3.**

(1) Let $f \colon S_1 \to S_2$ be a morphism of sheaves over $X$. Give a reasonable definition of an *image* subsheaf $\mathrm{im}(f) \subseteq S_2$.
(2) Give a reasonable definition of a *cokernel* sheaf $\mathrm{coker}(f)$ over $f$.
(3) Prove an analogue of the first isomorphism theorem for sheaves of abelian groups over spaces.
(4) How does your first isomorphism theorem look on stalks?